

CLAIMS

What is claimed as new and desired to be protected by Letters Patent of the United States is:

1. A system for exhausting smoke from a space having an upper boundary wherein the smoke accumulates at or near the upper boundary, comprising:
at least one make-up air shaft enabling outside air to enter the space, the make-up air shaft positioned at the upper boundary; and
means for enabling the make-up air shaft to deploy from a first condition, in which the entire make-up air shaft is at or near the ceiling, to a second condition, in which the make-up air shaft extends from the upper boundary of the space to below the smoke.
2. The system of claim 1, wherein the at least one make-up air shaft comprises a plurality of make-up shafts.
3. The system of claim 1, wherein the at least one make-up air shaft is longitudinally expandable from said first condition, in which the shaft is in a folded state, to said second condition, in which the shaft is longitudinally expanded relative to said first condition.
4. The system of claim 3, wherein the at least one make-up air shaft is foldable.

5. The system of claim 3, wherein the means for enabling comprises:
a fire detector; and
means for releasing the at least one make-up air shaft from its first condition
whereby the shaft is extended to said second condition by gravity.
6. The system of claim 1, wherein the upper boundary is a ceiling.
7. A system for exhausting smoke from a space having an upper boundary,
wherein smoke accumulates from the upper boundary downward, comprising:
at least one opening through the upper boundary to exhaust smoke from the
space; and
at least one make-up air shaft communicating through the upper boundary
with air outside the space and extending downward from the upper boundary to
below the smoke.
8. The system of claim 7, wherein the at least one opening comprises a
plurality of openings.
9. The system of claim 7, wherein the at least one make-up air shaft
comprises a plurality of make-up air shafts.
10. The system of claim 7, further comprising a buoyancy-driven ventilator
associated with the opening for exhausting smoke through the opening.

11. The system of claim 7, further comprising a power-driven ventilator associated with the opening for exhausting smoke through the opening.

12. The system of claim 7, wherein the shaft has a diameter, the space has a lower boundary, and the shaft extends downward from the upper boundary to within one diameter of the lower boundary.

13. The system of claim 7, wherein the shaft has a transverse cross-sectional area having a width, the space has a lower boundary, and the shaft extends downward from the upper boundary to within one said width of the lower boundary.

14. The system of claim 1, wherein the air shaft has a transverse flow area and an outlet, and the means for enabling comprises a contraction in the flow area adjacent to the outlet of the duct.

15. A method for exhausting smoke from a space having an upper boundary, wherein smoke accumulates from the upper boundary downward, comprising:

exhausting the smoke from the space through at least one opening in the upper boundary; and

introducing make-up air into the space through at least one make-up air shaft communicating through the upper boundary with air outside the space and extending downward from the upper boundary to below the smoke.

16. The system of claim 7, further comprising an arrangement enabling the make-up air shaft to deploy from a first condition, in which the entire make-up air shaft is at or near the ceiling, to a second condition, in which the make-up air shaft extends from the upper boundary of the space to below the smoke.

17. The system of claim 7, wherein the at least one make-up air shaft is longitudinally expandable from said first condition, in which the shaft is in a folded state, to said second condition, in which the shaft is longitudinally expanded relative to said first condition.

18. The system of claim 16, wherein the at least one make-up shaft is foldable.

19. The system of claim 16, wherein the means for enabling comprises:

a fire detector; and

means for releasing the at least one make-up air shaft from its first condition whereby the shaft is extended to said second condition by gravity.